Issued August 22, 1911.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 463.

THE SANITARY PRIVY.

BY

C. W. STILES,

Professor of Zoology, United States Public Health and Marine-Hospital Service, and Consulting Zoologist, Bureau of Animal Industry,

AND

L. L. LUMSDEN,

Passed Assistant Surgeon, United States Public Health and Marine-Hospital Service.

WASHINGTON
GOVERNMENT PRINTING OFFICE.
1911.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 6, 1911.

To the farmers of the United States:

Nothing is more important to the farmer than good health. Good health can not be preserved if the sanitary conditions of the farm are bad. Among the worst conditions ever to be found about any home is a soil that has become polluted with excrement from the human body. A number of widely prevalent diseases have been spread by means of such polluted soil, simply because the facts have not been generally known. This bulletin treats of such soil pollution and certain simple plans for avoiding it.

Having at heart the best interests of the American farmer and his family, I consider it my personal duty to appeal to every American farmer to weigh well the facts here presented, to do all in his power to remove any insanitary conditions that he may find on his farm or in his neighborhood, and thus, by protecting the members of his family, perform one of his highest patriotic duties.

JAMES WILSON,
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

UNITED STATES TREASURY DEPARTMENT,
PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE,
Washington, D. C., April 20, 1911.

SIR: With the approval of the Secretary of the Treasury, I have the honor to transmit herewith a manuscript entitled "The Sanitary Privy," prepared by C. W. Stiles and L. L. Lumsden, of the Hygienic Laboratory of this service. Professor Stiles is also consulting zoologist in the Bureau of Animal Industry, Department of Agriculture. For some years past these two officers have been making a special study of certain diseases which are particularly incident to farm life and of the methods by which these infections are spread, and their reports thereon have appeared in the publications of the Public Health and Marine-Hospital Service. These have been revised, and the manuscript, with the description of additional research work, is submitted, that it may become available through the Department of Agriculture to those living on farms, who naturally look to your department for such information.

Respectfully,

WALTER WYMAN,
Surgeon General.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

ILLUSTRATIONS.

THE SANITARY PRIVY.

SOIL POLLUTION.

It is common knowledge among intelligent farmers that in many instances when live stock, such as horses, cattle, sheep, or hogs, are pastured year after year in the same field, the animals do not thrive; in fact, that, sooner or later, many sicken and die; this is especially true of the young animals.

The explanation of this fact is clear. Animals harbor parasitic worms and germs in their intestines; the worms lay eggs, which are passed in the droppings; the eggs develop into young worms, which in turn reinfect the live stock. If a pasture is in constant use the ground becomes heavily infested with young worms and other germs; the smaller the pasture in proportion to the number of animals kept in it, the more intensified the soil pollution becomes. Warmth and moisture are especially favorable to the hatching out of worms from the eggs passed in the droppings, hence, during warm, moist seasons, or in warm, moist localities, the infection of the stock is likely to be more severe. The more heavily the animals are infected with parasites, the less they thrive; their digestion is weakened and their blood becomes watery, so that a considerable proportion of the food given them is wasted in that it does not go to make meat; their growth is retarded and their fertility is lessened; and finally infection reaches such a degree that many of the animals can no longer withstand it, and they sicken and die. Thus, the soil pollution of a field by the live stock eventually renders the pastures unfavorable for raising animals. The practical farmer, having observed this fact, moves his stock to other ground in order "to give the old pasture a rest;" by so doing he removes his animals from exposure to infection, allowing the infectious germs and young worms in the old pasture to die out.

The foregoing facts regarding the effects of soil pollution upon the health of animals, such as horses, sheep, cattle, swine, and chickens, apply with equal force to human beings, because human beings also harbor parasitic worms and germs, which are discharged in the excreta, pollute the soil, are again conveyed to people, and thus continue the round of infection at an increasing rate. Soil pollution by

---

NOTE.—A list giving the titles of all Farmers' Bulletins available for distribution will be sent free upon application to a Member of Congress or the Secretary of Agriculture.

human excreta endangers the health of a family, just as soil pollution of a pasture by the droppings of animals endangers the live stock.

In order to prevent the evil effects of soil pollution from extending to his live stock, the farmer must resort to more or less expensive methods, such as purchase of additional pasture lands or burning the pasture. But since human beings, on account of their superior intelligence, can be taught to frequent an appointed place to deposit their excreta, it is possible (by the expenditure of a few dollars for a sanitary privy) to prevent soil pollution with human excreta, thereby protecting the family, and enabling it to live year after year on the same premises (family pasture) without danger, at the same time saving doctors' bills and avoiding unnecessary sickness and death.

DISEASES SPREAD FROM MAN BY SOIL POLLUTION.

It is especially the diseases caused by parasites (both animal and bacterial) of the intestine, lungs, liver, kidneys, and bladder that are spread by soil pollution. Some of these diseases are spread from human being to human being; others are spread from human beings to the farm animals. Therefore, in preventing soil pollution by persons, both families and live stock are protected.

The proper disposal of human excreta is recognized by sanitarians as the most important measure needed to prevent the spread of typhoid fever, hookworm disease, the dysenteries, and certain other widely prevalent diseases.

DISEASES SPREAD FROM MAN TO MAN.

Some of the diseases which come under this heading are caused by microscopic parasites known as bacteria; others by animal parasites, which are considerably larger than the bacteria.

BACTERIAL DISEASES.

Among the most important diseases under this heading may be mentioned typhoid fever, dysentery and diarrhea ("summer complaint"), and tuberculosis ("consumption").

Typhoid fever.—Every person who contracts typhoid fever does so because he has recently swallowed some typhoid germs that have been passed in the stools or urine of some other person, who either (as a patient) was suffering from typhoid or (as a "carrier") was carrying the germs without showing symptoms.

The germs (bacilli) of typhoid fever are of very minute size, a single germ (bacillus) being only about $\frac{1}{12000}$ of an inch in length

and only about $\frac{1}{3600}$ of an inch in thickness. Like molds and yeasts, they are plants, and under favorable conditions (as in milk, for instance) they multiply at a very rapid rate, so that in a few hours a single germ may increase to thousands. Thousands of these little germs may be contained in a particle of feces no larger than the head of an ordinary pin, or in a small drop of urine, and hundreds may be carried on the leg of a fly (fig. 1). A person suffering from typhoid fever discharges myriads of these germs in the stools and urine. Therefore, the excreta from typhoid patients should be regarded as highly poisonous, and everything which may become soiled with the smallest quantity of feces or urine should be thoroughly disinfected by heat or chemicals.

After being discharged in the excreta from the bodies of persons, typhoid germs gradually die out, but the length of time during which they will survive in the excreta is affected by a number of conditions; in some instances they have been found to live for over a year in the contents of privies and privy vaults and in excreta mixed with earth. Therefore, excreta which have been passed through a septic tank or which have been stored for months in a privy or privy vault should not be regarded as being free from typhoid germs.

FIG. 1.—A fly with germs (greatly magnified) on its legs.

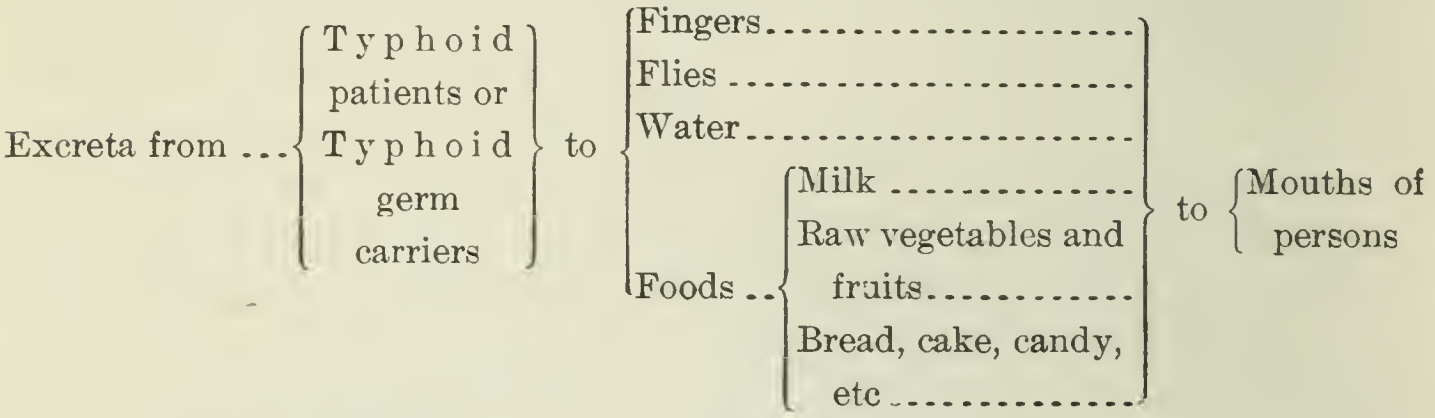
Persons in the early stages of typhoid fever, before becoming ill enough to take to bed (and some time perhaps before the physician is called in), may discharge typhoid germs in their excreta. Some persons contract infection and though having symptoms of the disease in a mild form ("walking cases of typhoid fever") never become ill enough to give up and take to bed. Other persons contract and harbor the infection for a few days or weeks without showing any symptoms whatever ("temporary typhoid-bacillus carriers"). In many instances the excreta from such persons are as heavily charged with typhoid germs as are those from persons suffering with the severest attacks of the disease. Some persons recovered from attacks of the disease continue to discharge typhoid germs in their stools or urine, or both, for weeks, months, or even years ("chronic typhoid-bacillus carriers"). In view of all these now thoroughly established facts, it is evident that to prevent the spread of typhoid infection from persons it is necessary to dispose properly of the excreta from all persons at all times. This can be done by the use of sanitary privies.

If the excreta are not properly disposed of it is readily understood that the germs may be carried in a number of ways to the

water or food supplies, and then be swallowed by and cause infection in persons. They may be carried by drainage or seepage or tracked on the feet of persons, live stock, and poultry to the well or spring. They may be carried directly by flies from the excreta to the foods in the kitchen or dining room. If spread about the place they will from time to time get on the hands of persons, and thence into the water or foods.

Some of the ways in which typhoid germs in the excreta from infected persons may be conveyed to other persons are shown in the following diagram:

Diagram of modes of spread of typhoid fever.



The foregoing diagram shows that the easiest way of protecting against typhoid fever is to dispose of the excreta in such a manner that the germs contained therein can not be spread. This can be done by using sanitary privies.

Dysentery and diarrhea ("summer complaint").—Dysentery and similar infections can be prevented in the same way as typhoid fever, as their method of spread is the same.

Tuberculosis.—Although the danger of spreading tuberculosis by spitting must be constantly held in mind, it is important to remember also that many tubercle bacilli may be discharged in the feces, because persons with lung tuberculosis ("consumption") frequently swallow their sputum, and also because some persons have tuberculosis of the bowels. The spread of tuberculosis by soil pollution may be prevented by using sanitary privies.

PARASITIC DISEASES.

Among the diseases caused by animal parasites, and spread by soil pollution from man to man, there may be mentioned, especially, hookworm disease, Cochin-China diarrhea, eelworm infection, pinworm infection, blood-fluke infection, amœbic dysentery, and many other diseases. In some of these maladies the infection is spread in much the same way as is that of typhoid fever, the germs being swallowed; in others the infection may take place through the skin. All of these diseases can be prevented by using sanitary privies.

Hookworm disease.—There are in this country at least 2,000,000 cases of hookworm disease. The parasites, which are about half an inch long, attach themselves to the wall of the bowels, which they wound, and from which they suck blood.

The worms lay eggs which are passed in the stools and which escape from the body in no other way. If the ground is polluted by the human excreta, this disease spreads, but if the excreta are deposited in a sanitary privy, and properly disposed of, the disease can be easily prevented.

Under favorable conditions, from these eggs, which are too small to be seen with the naked eye, hatch out within a few hours tiny worms; these worms grow and shed their skin, much like a snake; when about one to two weeks old, but still only about one-fortieth of an inch long and therefore scarcely visible to the naked eye, they may be swallowed, or they may burrow through the skin, especially of barefooted children, and cause that condition known as "ground itch," "dew itch," "dew sores," "toe itch," etc. Wherever "ground itch" exists, it is proof that somewhere in that locality soil pollution has occurred, because there is a privy which is either not properly built, or not properly taken care of, or not properly used, or because there is no privy at all.

From the skin these tiny worms get into the blood and gradually make their way to the bowels, where they grow to adult worms, and in their turn lay eggs.

If any member of the family or any person on the farm is pale, weak, or sickly, and has had "ground itch" within 10 years past, the family physician should be consulted as to whether the trouble is due to hookworms. In many of the States the State board of health will either make or have made a microscopic examination, free of charge, to determine the point definitely.

Although hookworm disease may have serious effects, even resulting in death, it can be easily cured at a slight expense, and it can be entirely eradicated if sanitary privies are built and used.

Cochin-China diarrhea.—This is a disease which is spread very much in the same way as hookworm disease. It is very difficult to treat successfully, but it can be absolutely prevented by the use of sanitary privies.

Eelworm infection.—The eelworms are about as large as a lead pencil, and are found among children. Whenever found they prove that there is something wrong with the sanitary conditions.

Amœbic dysentery.—This is a very serious disease. It may cause death, but its spread can be prevented by the use of sanitary privies.

PARASITIC DISEASES SPREAD FROM MAN TO LIVE STOCK AND THEN BACK TO MAN.

At least two kinds of tapeworms are spread from man to live stock and back to man because of lack of sanitary privies.

Beef-measle tapeworm.—This tapeworm, when harbored in the intestine of man, lays thousands of eggs, which are discharged in the stools, and if scattered about may be swallowed by cattle. Here they cause "beef measles," reducing the value of the beef. By eating measly beef man may become infected with this tapeworm.

Pork-measle tapeworm.—The eggs of this tapeworm are passed in the stools of man and swallowed by swine, in which they cause "pork measles." By eating such pork man may become infected with tapeworms. This tapeworm is especially dangerous, because if a person harbors it and pollutes the soil with his excreta containing the eggs, these eggs may be swallowed by persons and cause a serious disease known as "pork measles" in man, which may cause blindness, insanity, and death.

Both of these tapeworm infections can be prevented by the use of sanitary privies.

HUMAN EXCREMENT AS A BREEDING PLACE FOR FLIES.

Flies and many other insects feed upon and breed in filth, such as manure and human excrement. Whenever a fly is seen it is positive proof of the existence of some filth in the neighborhood. It is much more filthy and much more dangerous to have flies in the kitchen and dining room than to have bedbugs in the bedroom.

Flies can carry various disease germs to man. By so doing they kill thousands of people, especially babies, every year; therefore kill the flies and save the babies.

If flies have access to human excrement, they not only feed upon it, but they lay their eggs in it. After a few hours the egg hatches out a maggot; this feeds in the filth for several (about five) days and then forms a pupa; after about five days the adult fly comes out of the pupal case, feeds on the filth, and carries disease germs from the filth to the house, depositing these germs on the foods. Thus flies carry disease to people. A fly drops his excrement about once every $4\frac{1}{2}$ minutes and may spread germs not only in this way, but also with his feet, wings, and mouth parts.

Even if excrement containing fly maggots is buried under as much as 6 feet of sand, the maggots can crawl to the surface, bringing disease germs with them.

Thus it is clear that if flies are kept away from human excrement, not only will they decrease in numbers, but they will be prevented from spreading certain diseases, such as typhoid fever. This can be done by the use of sanitary privies.

PRIVY CONDITIONS ON SOME AMERICAN FARMS.

The privy on the American farm possibly has not received the attention that its importance deserves. Some American farms have no privy at all. This means that some farm families are being needlessly exposed to sickness and death. It means that these families are following a custom which not only needlessly increases sickness and death, but which decreases the value and productiveness of their farms. The warmer, more moist, and more shaded the locality, the greater is the danger resulting from lack of sanitary privies.

City health authorities are gradually awakening to the dangers connected with the supplies of milk, fresh vegetables, and fresh fruits from insanitary farms; hence not only from the standpoint of preserving the health of persons living on farms and increasing the productiveness of the farms, but also from the standpoint of marketing farm produce, it is important for farms to be provided with sanitary privies.

DIFFERENT KINDS OF PRIVIES.

The popular idea of the purpose of a privy.—To the popular mind a privy (as indicated by its name) is a structure to which a person may retire in private when responding to the daily calls of nature. In the minds of most persons modesty and privacy are the chief considerations which lead to the construction of a privy. As such privacy may be secured by a clump of bushes or a grove of trees, some persons consider a privy unnecessary.

Modesty and privacy are laudable objects, but all must agree that they are of infinitely less importance than the great object of saving human life by preventing the spread of disease.

The essential parts of a privy.—A privy should consist of two chief parts, namely: First, a receptacle for the excreta; secondly, a room to insure privacy.

The essential problems in constructing a privy.—From the foregoing it is clear that the two great problems to be held in mind in constructing a privy are: First, to protect the receptacle for the excreta in such a way that the germs can not be spread; secondly, to construct the entire outhouse in such a way that persons will seek to use it and not to avoid it—in other words, not only must it insure privacy, but it must not be a disagreeable place in which to be private. This latter point is especially important in warm climates, for many a privy is so disagreeable in warm weather that people, especially men, very frequently avoid it. Still another point must be considered, namely, the cost of construction and maintenance must be brought within the purse limits of the poor as well as of the well-to-do family.

The kinds of privies that are not sanitary.—If the excreta are scattered broadcast, the infection they contain is also scattered far and wide. If the excreta are deposited in one place, the infection they contain is more restricted. Therefore, any kind of privy is better than none. From a faulty privy, however, much infection may be spread in various ways, as, for instance, by drainage and seepage, or by chickens, swine, and dogs, or by the feet of persons, or by insects, especially flies.

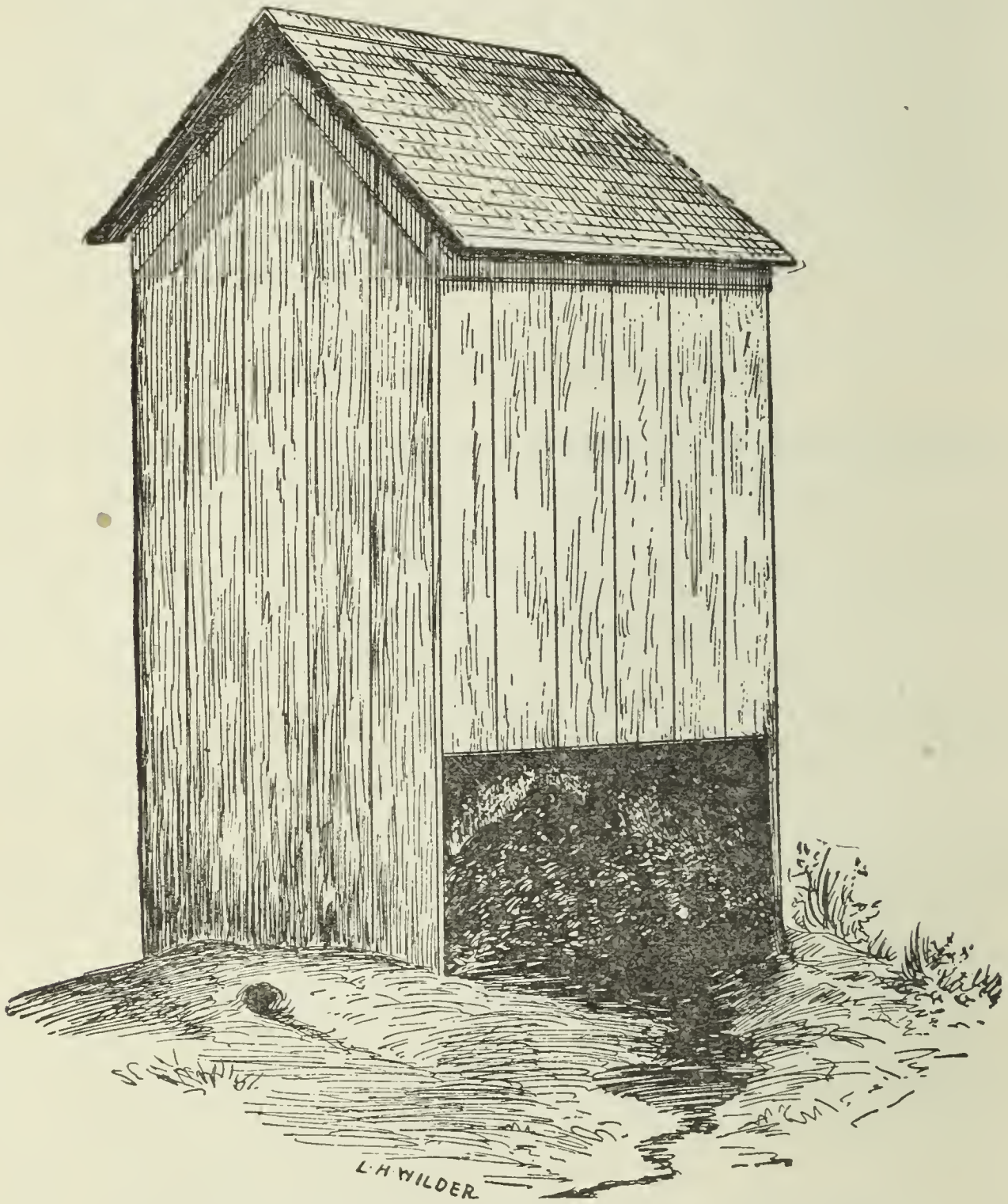


FIG. 2.—An insanitary privy, open in back. (Stiles, 1910.)

Figure 2 represents a dangerous type of privy. On a systematic rating it should not be marked higher than 10 on a scale of 100, therefore it is 90 per cent below perfect. The protection afforded by this privy depends in great measure upon the frequency with which the excrement is removed. But even if this privy is cleaned every day, chickens, hogs, and flies have access to the fresh night soil for a

number of hours, and, besides that, the ground under and around the outhouse becomes polluted.

Even if such a privy is provided in the back with a tightly fitting trapdoor, so as to exclude domesticated animals and to prevent the toilet paper from being blown about, its efficiency is increased by only about 15 points, so that it should not be ranked more than 25 on a scale of 100. Insects, such as flies, ants, and roaches, still have access to the night soil, which also pollutes the ground under and around the privy.

The kinds of privies that are sanitary.—A sanitary privy must meet the following requirements:

(1) The excreta must not touch the ground; hence some kind of water-tight receptacle (box, pail, tub, barrel, tank, or vault) for the excreta must be used under the seat.

(2) Domesticated animals must not have access to the night soil; therefore the privy should have a trapdoor in the back to exclude them.

(3) Flies and other insects must not have access to the excreta; therefore the entire privy must be made rigidly flyproof, or some substance must be used in the receptacle to protect the contents from insects.

Two types of sanitary privies are generally recognized, namely, the so-called "dry system" and the so-called "wet system."

THE "DRY SYSTEM."

In the "dry-system" privies dry earth, road dust, wood ashes, or lime is kept in the privy, and is scattered on the excreta every time the privy is used.

The dry system, if properly managed, presents the following advantages:

(1) It decreases the offensiveness of the privy contents.

(2) It is cheap.

(3) It decreases the chance of spread of infection by insects.

(4) It is an easy system to manage.

The disadvantages of the dry system are the following:

(1) It is very difficult to make a dry privy rigidly fly proof, hence flies usually do have more or less access to the excreta, on which they feed and on which they lay their eggs.

(2) Its efficiency depends upon the careful and faithful cooperation of all persons (including children) who use the privy, and experience shows that such cooperation can not be relied upon.

(3) It increases the amount of material to be removed; hence it increases the labor and frequency of necessary cleaning.

(4) Experience shows that it is exceptional that the excrement is properly covered with dry earth or lime; hence the system is not so efficient as is popularly supposed.

(5) Neither dry earth nor lime, in practical usage, can be relied upon to destroy all disease germs which may be in the excreta; hence their use is likely to give rise to a false sense of security in the public mind.

(6) If the dejecta at the time of burial contain fly grubs these larvæ may crawl through the earth to the surface, where they can complete their development into adult flies and spread infection from the buried night soil.

Privies of the "dry system" should not be marked more than 75 points on a scale of 100.

Figures 6 and 7 (pages 22 and 23) represent an outhouse which may be used as a dry privy.

THE "WET SYSTEM."

In the "wet-system" privies some fluid is used in the receptacle either (1) to disinfect the excreta, or (2) to act as an insect repellent, or (3) to increase the destruction of disease germs in the excreta by natural fermentation. Figures 6 and 7 represent outhouses which can be used as "wet-system" privies.

The advantages of the "wet system," when applied to outhouses shown in figures 6 and 7, are:

(1) It decreases the offensiveness of the privy contents.

(2) It is cheap.

(3) It greatly decreases the chances of spread of infection by flies because they can not breed in the excreta; hence rigid fly screening is not so necessary.

(4) It kills or renders harmless a considerable proportion of certain infections contained in the excreta.

(5) Its efficiency does not depend upon the intelligence or cooperation of all persons using it.

The disadvantages of the "wet system," as applied to outhouses shown in figures 6 and 7, are:

(1) It is more difficult to keep clean than the "dry system," because of the danger of soiling the floor when the receptacle is emptied.

(2) Unless the receptacle is very deep there is likely to be more or less splashing.

(3) The labor and frequency of cleaning are about the same as in the case of the "dry system."

If the wet system is used it is best to fill the receptacle about one-fourth full of water, on the surface of which a cup of petroleum is poured. The petroleum acts as an insect repellent.

Two sets of receptacles should be provided. While one set is being used under the seat, the other set is covered and permitted to stand so as to lengthen the period of fermentation.

THE L. R. S. PRIVY.[1]

On account of the various objections raised against the different styles of privies now in use, an effort has been made to construct a device which will decrease the disadvantages and at the same time increase the advantages connected with the older types of outhouses. The results obtained from various experiments have been applied to an apparatus known as the L. R. S. privy (figs. 3, 4, and 5).

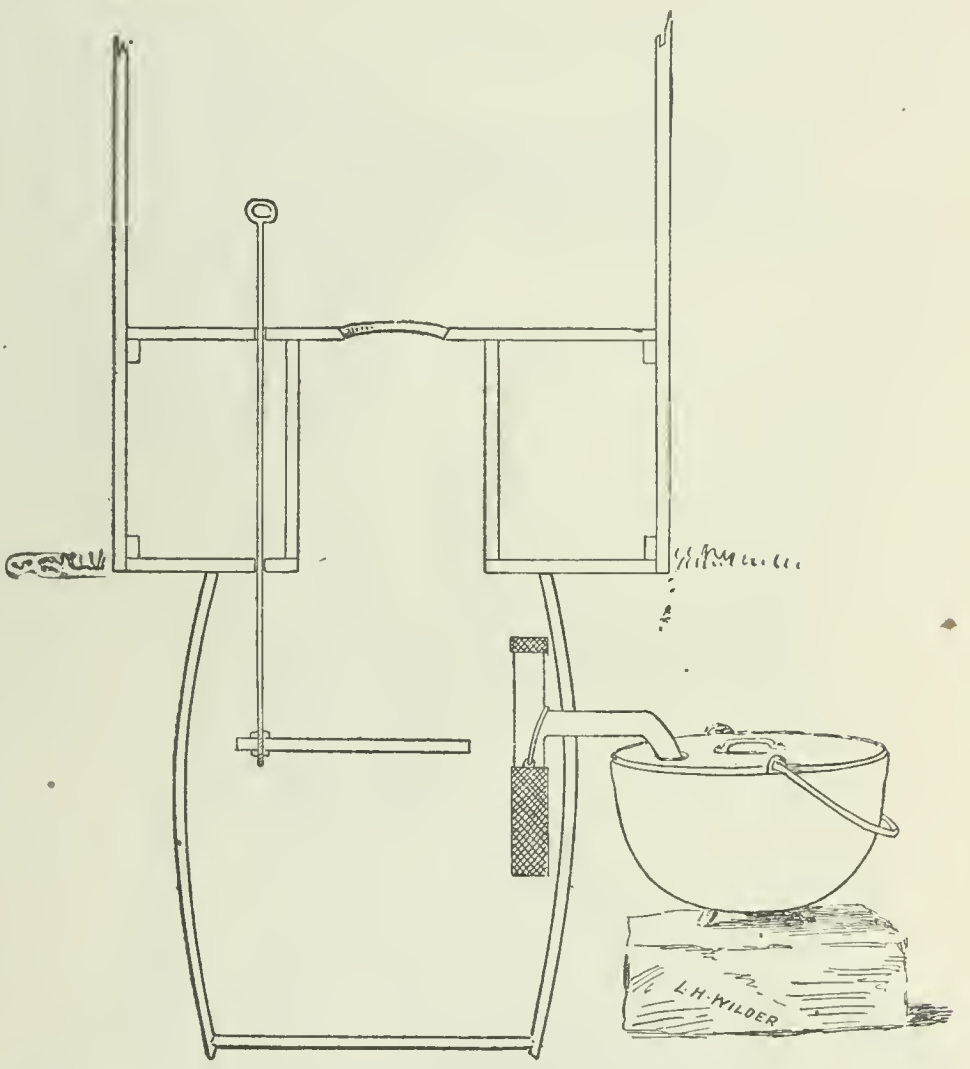


FIG. 3.—Improved L. R. S. privy.

This apparatus consists of the following parts:

(1) A water-tight barrel or other container to receive and liquefy the excreta.

(2) A covered water-tight barrel, can, or other vessel to receive the effluent or outflow.

(3) A connecting pipe about 2½ inches in diameter, about 12 inches long, and provided with an open T at one end, both openings of the T being covered with wire screens.

(4) A tight box, preferably zinc lined, which fits tightly on the top of the liquefying barrel. It is provided with an opening on top for the seat, which has an automatically closing lid.

(5) An antisplashing device consisting of a small board placed horizontally under the seat about an inch below the level of the transverse connecting pipe; it is held in place by a rod, which passes through eyes or rings fastened to the box, and by which the board is

[1] Lumsden, Roberts, and Stiles: Preliminary note on a simple and inexpensive apparatus for use in safe disposal of night soil. Public Health Reports, 1910, Nov. 11, v. 25 (45), pp. 1619–1623, fig. 1.

raised and lowered. The liquefying tank is filled with water up to the point where it begins to trickle into the effluent tank.

As an insect repellent a thin film of some form of petroleum may be poured on the surface of the liquid in each barrel.

Practical working of the apparatus.—When the privy is to be used, the rod is pulled up so that the antisplashing board rises to within about 1 inch below the surface of the water. The fecal material

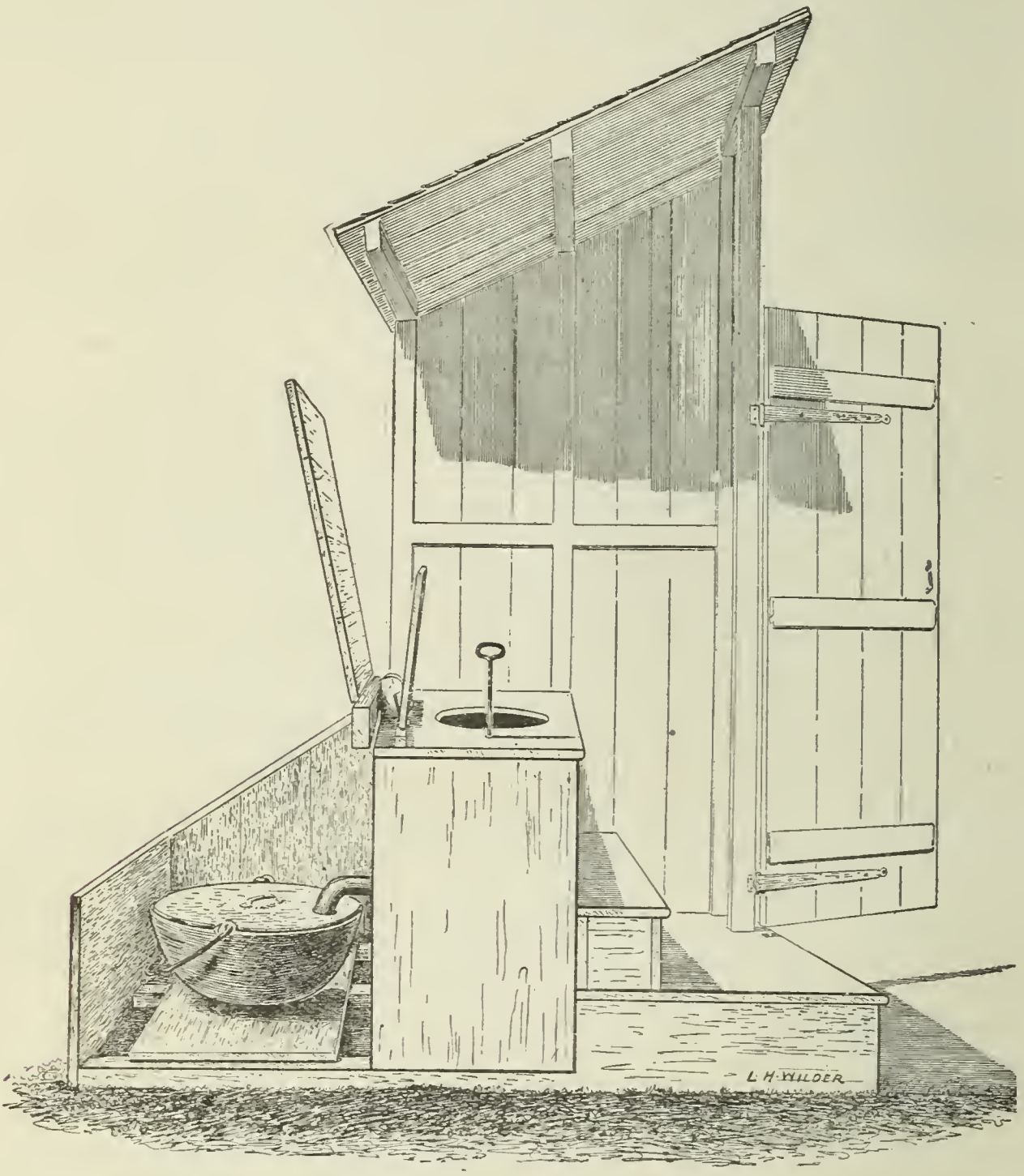


FIG. 4.—Inside view of L. R. S. privy.

falls into the water, but this board prevents splashing, and thus overcomes one of the greatest objections thus far raised to the wet system. After use, the person sinks the antisplashing board by pushing down the rod, and the fecal matter then floats free into the water.

Although some of the fecal matter floats, it is protected both from fly breeding and fly feeding in the following ways: First, by the

automatically closing lid; second, by the water; third, by the film of oil; and, fourth, by having the apparatus located in a screened place, which should be done for additional safety. The film of oil also prevents the breeding of mosquitoes in the barrel. Accordingly, so far as the privy as a breeding or feeding place of flies and mosquitoes is concerned, the model in question completely solves the problem.

The fecal material becomes fermented in the water and gradually liquefies; as the excreta settle, the level of the liquid is raised and the excess flows into the effluent tank, where it is protected from insects by the cover and by a film of oil. This effluent may be allowed to collect in the tank until it reaches the level of the connecting pipe, when it may be safely disposed of in various ways to be discussed later.

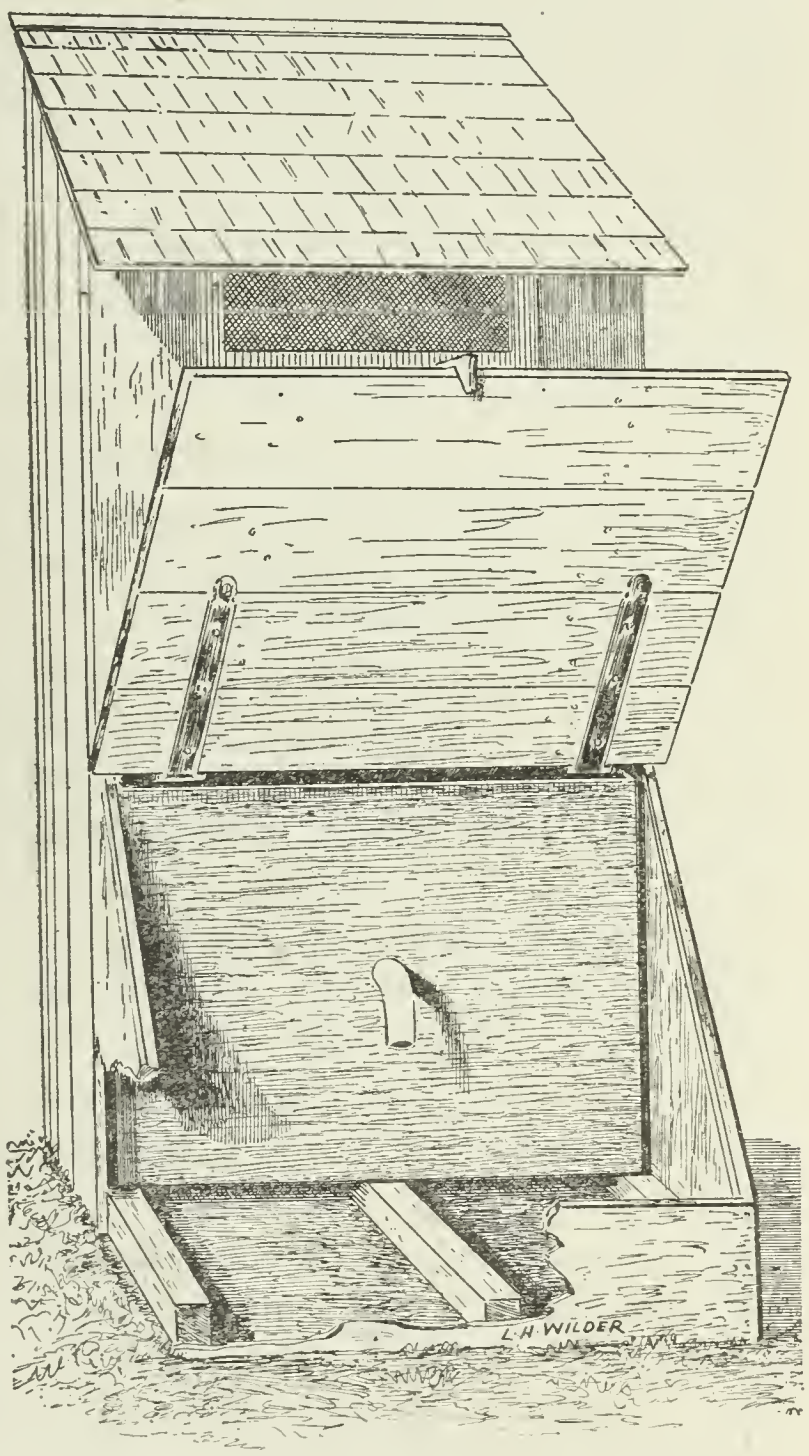


FIG. 5.—Rear view of L. R. S. privy.

It is thus seen that this device appears to meet the following requirements:

(1) It solves the fly problem and the mosquito problem, so far as the privy is concerned.

(2) It liquefies fecal material and reduces its volume, so that it may be safely disposed of more easily and cheaply than the night soil from other types of privies.

(3) It reduces odor.

(4) It reduces the labor of cleaning the privy and makes this work less disagreeable.

(5) It is of simple and inexpensive construction.

This device has been in constant operation in one of the workrooms on the main floor of the Hygienic Laboratory at Washington for 8 months and has been found entirely satisfactory. From July 12, 1910, to April 1, 1911, namely, 262 days, it has been used 738 times, giving an average of $2\frac{4}{5}$ defecations (with urination) per

day. The amount of overflow (effluent) from the liquefying tank has been 59 gallons. The liquefying tank itself consists of an ordinary water-tight 40-gallon whisky barrel, and it has not been necessary thus far either to add water or to empty it.

Tests of this device are now being made in out-of-doors privies in order to determine the effect upon it of varying conditions of temperature and humidity. Tests are also being made to bring out whatever objectionable features may arise in connection with its general use and to determine the simplest methods of managing the device so that any family will have no difficulty in keeping it in proper working order.

The handle of the antisplasher should come up through the seat board at the side of the hole. By this arrangement the antisplasher can be raised entirely out of the water and thus used to sink the toilet paper and fecal matter if too much floats on the surface.

As an effluent tank, various receptacles can be utilized. If an iron pot is used, place on stones or provide with legs so that a space is left under it to permit the building of a fire as the effluent can be easily and cheaply disinfected by heat.

As a liquefying tank one may use either a barrel or an iron tank, or a box, or a brick vault, or a concrete vault. Whatever is used for this purpose must be strictly water-tight. Iron or concrete will cost more than wood, but on account of greater durability will be more economical in the long run.

The larger the family the larger the liquefying tank must be. A 40-gallon barrel, such as a whisky or oil barrel, seems sufficient for a family of 3 adults. For a larger family, the capacity should be increased by using two or more barrels or one larger receptacle, in the proportion of about 40 gallons capacity to every 3 to 4 adults in the family.

One advantage the device possesses is that with very little expense it can be put in the outhouses already in use; in fact, it can be placed in any of the outhouses on the farm, such as barn or woodshed, and thus save the expense of building for this special purpose. Wherever put, it is very important to have it in a place screened against flies.

From the out-of-door experiments thus far it can be readily foreseen that two factors come into consideration which have not been found important in the indoor privy, namely, evaporation and changes of temperature.

In cold weather the fermentation is not so rapid as in warm weather, and on this account the contents of the liquefying tank may gradually thicken.

The evaporation out of doors will vary greatly with the wind, humidity, and temperature in different regions, and the greater the evaporation the thicker the material in the liquefying tank becomes.

Should such thickening occur, the odor will increase, and it will be necessary to add water to the liquefying tank. In order to prevent such thickening, it may be found necessary in some instances to add water from time to time. Just how often and how much water should be added, under adverse conditions, has not yet been determined, but, so far as can be foreseen at present, probably a bucketfull (about 2 gallons) added once a week will be sufficient for a single barrel used by a family of 3 or 4 adults.

Experiments have conclusively demonstrated that the principle of the L. R. S. privy is good. The details regarding the addition of water must be determined experimentally in different localities. Any intelligent farmer should be able to determine this point for his own locality.[1]

If this type of privy is managed fairly intelligently, the indications are that the liquefying tank will rarely need cleaning, probably not oftener than once in several years. When cleaning does become necessary, this can be done in several ways: The barrel may be taken out, and its contents burned; or the contents may be pumped or dipped out, and burned; or a considerable amount (several barrelfuls) of water can be poured gradually into the liquefying tank, and the sludge thoroughly stirred until it runs over into the effluent tank.

In the experimental L. R. S. privy the only paper used has been the regular toilet paper. This has liquefied with sufficient promptness. If heavier paper (such as newspaper) were used, this would break up more slowly, and allowance for it might have to be made by increasing the capacity of the tank. It is well to bear in mind that the ink on newspaper is likely to irritate the skin. Corncobs and similar objects would certainly interfere materially with the successful working of any apparatus of this kind.

DIRECTIONS FOR BUILDING A SANITARY PRIVY.

There are many different ways that a privy building can be constructed. The details of construction are here appended for only one of the many different styles.

In order to put the construction of a sanitary privy for the home within the carpentering abilities of boys, a practical carpenter has been requested to construct models to conform to the general ideas expressed in this article and to furnish estimates of the amount of

[1] It should be understood that the L. R. S. privy is described simply as a type, and may be modified to suit varying conditions.

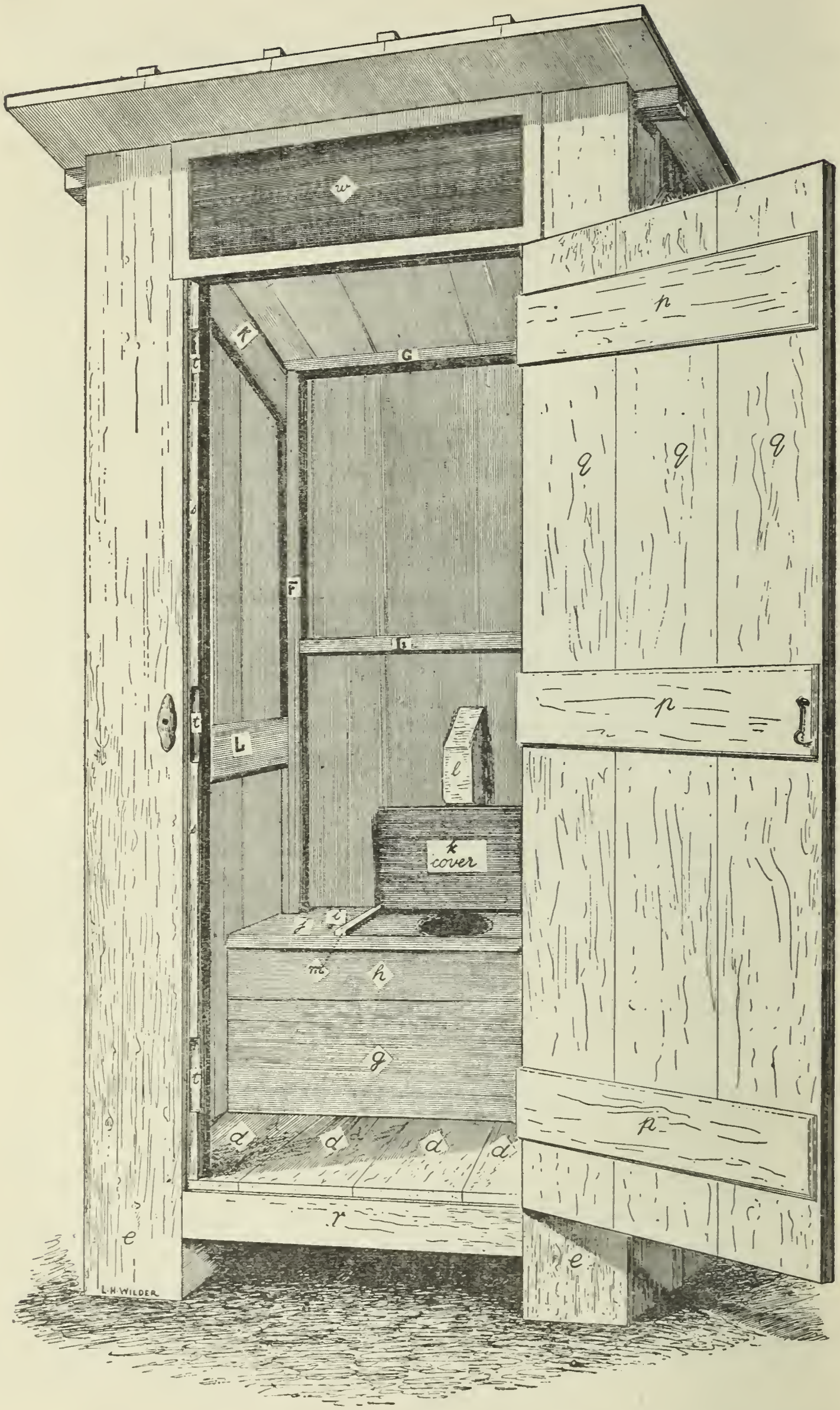


FIG. 6.—A single-seated sanitary privy. Front view. (Stiles, 1910.)

463

lumber, hardware, and wire screening required. Drawings of these models have been made during the process of construction (figs. 8, 9) and in completed condition (figs. 6, 7). The carpenter was requested to hold constantly in mind two points, namely, (1) economy and (2) simplicity of construction. It is believed that any 14-year-

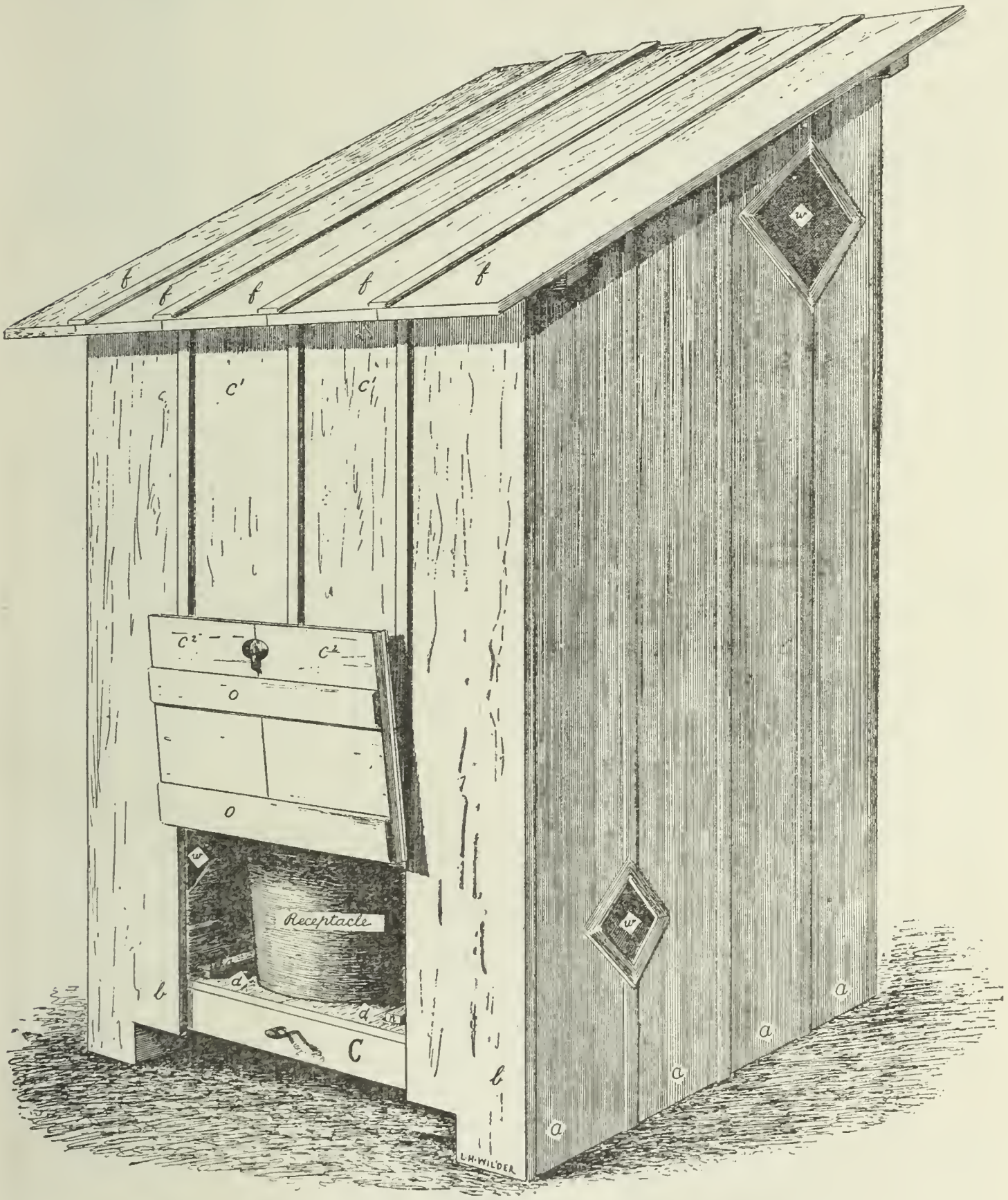


FIG. 7.—Rear and side view of a single-seated sanitary privy.

old school boy of average intelligence and mechanical ingenuity can, by following these plans, build a sanitary privy for his home at an expense for building materials, exclusive of receptacle, of $5 to $10, according to locality. It is further believed that the plans submitted cover the essential points to be considered. They

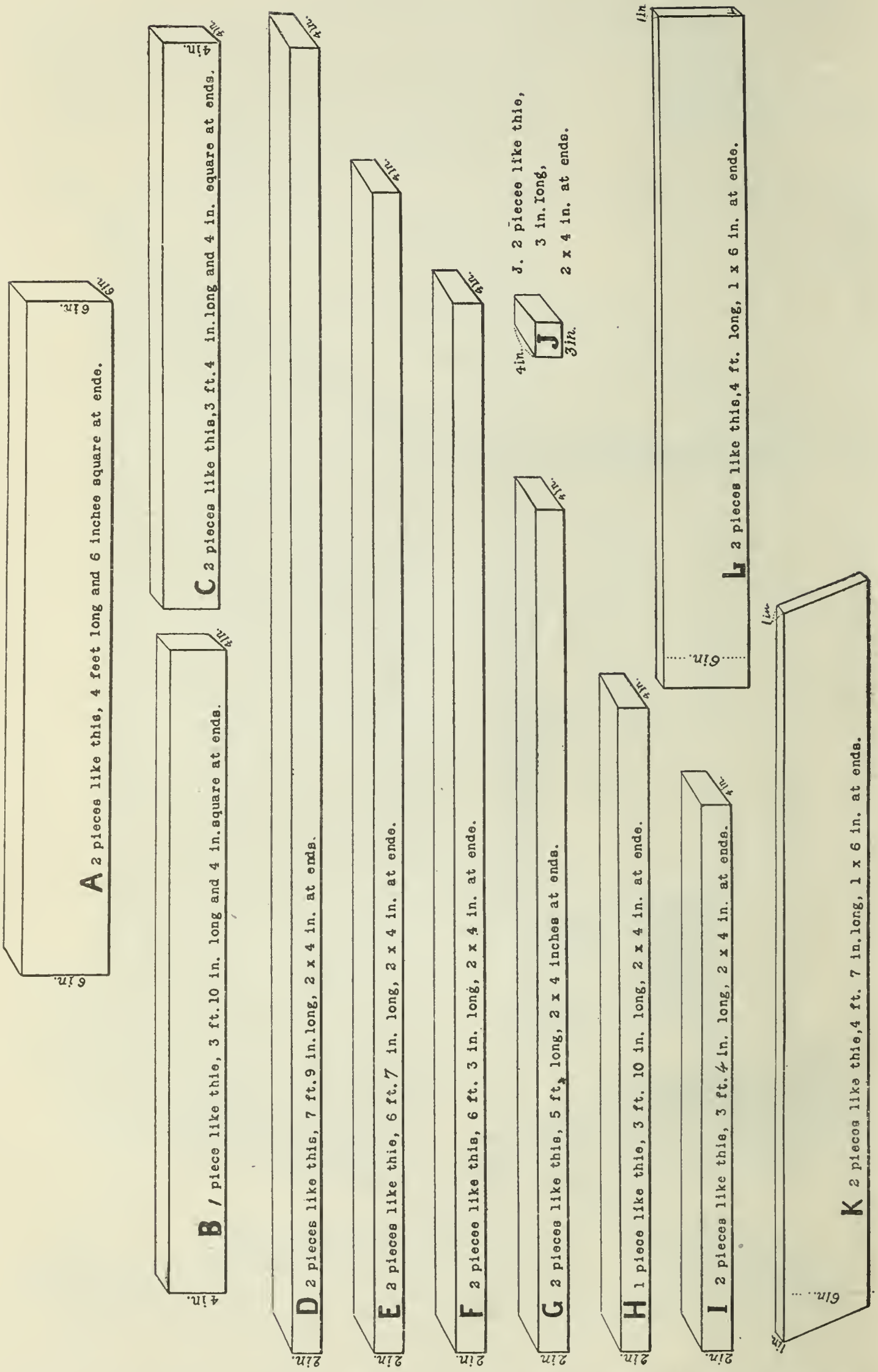


FIG. 8.—The scantling necessary for the framework of a single-seated sanitary privy, fig. 6. (Stiles, 1910.)

463

can be elaborated to suit the individual tastes of persons who prefer a more elegant and more expensive structure. For instance, the roof can have a double instead of a single slant, and can be shingled; the sides, front, and back can be clapboarded, or they can be shingled. Instead of one seat (figs. 6, 7), there may be two, three, four, five, or six seats, according to need.

A SINGLE-SEATED PRIVY.

Nearly all privies for the home have seats for two persons, but a single-seated privy can be made more economically.

Framework.—The lumber required for the framework of the outhouse shown in figure 6 is as follows (see figs. 8, 9):

A, two pieces, 6 by 6 inches, 4 feet long.
B, one piece, 4 by 4 inches, 3 feet 10 inches long.
C, two pieces, 4 by 4 inches, 3 feet 4 inches long.
D, two pieces, 2 by 4 inches, 7 feet 9 inches long.
E, two pieces, 2 by 4 inches, 6 feet 7 inches long.
F, two pieces, 2 by 4 inches, 6 feet 3 inches long.
G, two pieces, 2 by 4 inches, 5 feet long.
H, one piece, 2 by 4 inches, 3 feet 10 inches long.
I, two pieces, 2 by 4 inches, 3 feet 4 inches long.
J, two pieces, 2 by 4 inches, 3 inches long.
K, two pieces, 1 by 6 inches, 4 feet 7 inches long. The ends of K should be trimmed after being nailed in place.
L, two pieces, 1 by 6 inches, 4 feet long.

First lay down the sills marked A, and join them with the joist marked B; then nail in position the two joists marked C, with their ends 3 inches from the outer edge of A; raise the corner posts (D and F), spiking them at bottom to A and C, and joining them with L, I_2, G, and K; raise doorposts E, fastening them at J, and then spike I_1 in position; H is fastened to K.

Sides.—Each side (fig. 7) requires four boards (*a*) 12 inches wide by 1 inch thick and 8 feet 6 inches long; these are nailed to K, L, and A. The corner boards must be notched at G, allowing them to pass to bottom of roof; next draw a slant from front to back at G–G on the outside of the boards, and saw the four side boards to correspond with this slant.

Back.—The back (fig. 7) requires two boards (*b*) 12 inches wide by 1 inch thick and 6 feet 11 inches long, and two boards (*c*) 12 inches wide by 1 inch thick and 6 feet 5 inches long. The two longest boards (*b*) are nailed next to the sides; the shorter boards (*c*) are sawed in two, so that one piece (c^1) measures 4 feet 6 inches, the other (c^2) 1 foot 11 inches; the longer portion (c^1) is nailed in position above the seat; the shorter portion (c^2) is later utilized in making the back trapdoor.

Floor.—The floor (fig. 6) requires four boards (*d*) which (when cut to fit) measure 1 inch thick, 12 inches wide, and 3 feet 10 inches long.

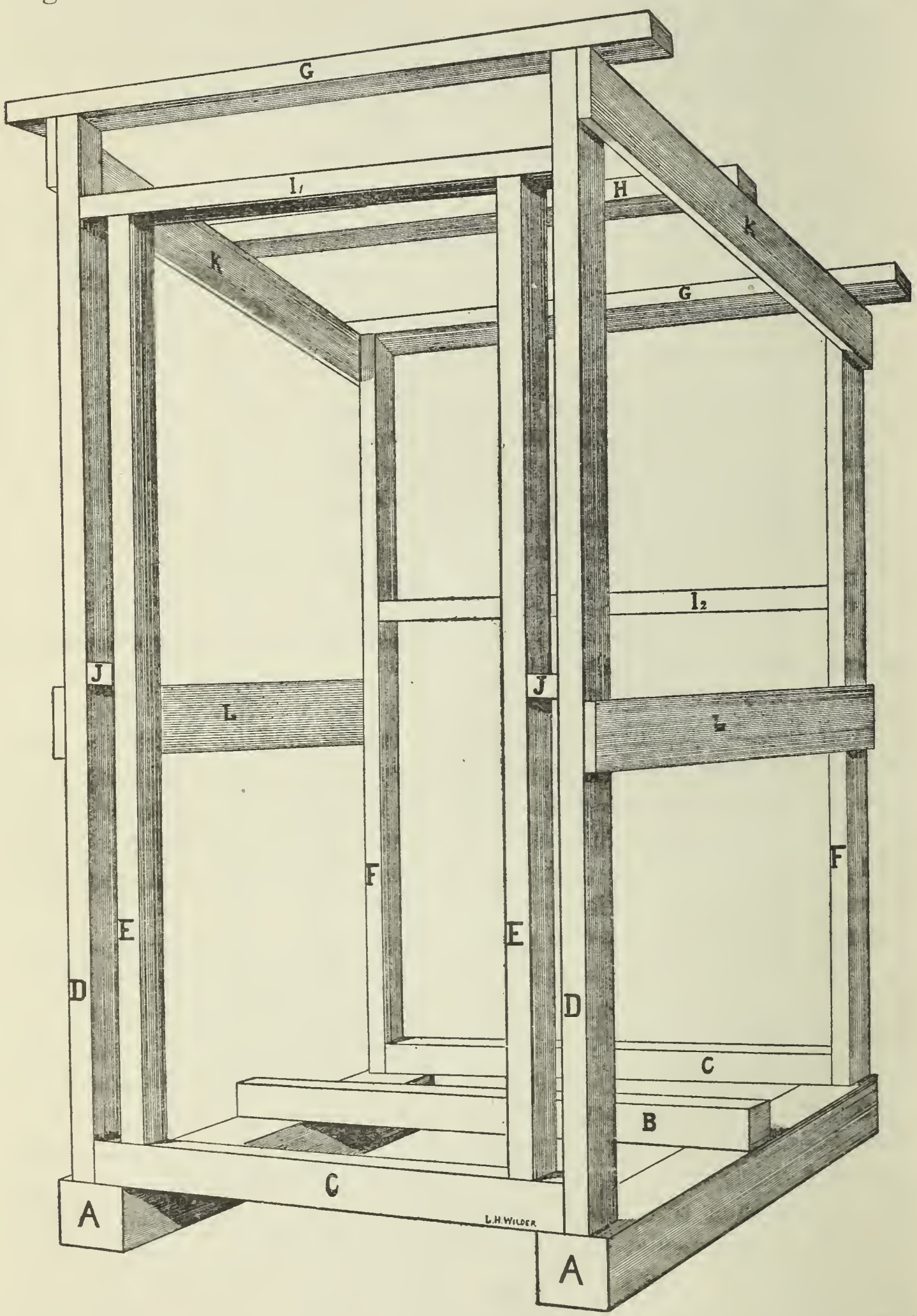


FIG. 9.—The framework (assembled) for a single-seated sanitary privy. (Stiles, 1910.)

Front.—The front boards may next be nailed on. The front (fig. 6) requires (besides the door) two boards (*e*), which (when cut to

fit) measure 1 inch thick, 9 inches wide, and 8 feet 5 inches long; these are nailed next to the sides.

Roof.—The roof (fig. 7) may now be finished. This requires five boards (*f*) measuring (when cut to fit) 1 inch thick, 12 inches wide, and 6 feet long. They are so placed that they extend 8 inches beyond the front. The joints (cracks) are to be broken (covered) by laths $\frac{1}{2}$ inch thick, 3 inches broad, and 6 feet long.

Box.—The front of the box (fig. 6) requires two boards, 1 inch thick and 3 feet 10 inches long. One of these (*g*) may measure 12 inches wide, and the other (*h*) 5 inches wide. These are nailed in place, so that the back of the boards is 18 inches from the inside of the back boards. The seat of the box requires two boards, 1 inch thick, 3 feet 10 inches long; one of these (*i*) may measure 12 inches wide, the other (*j*) 7 inches wide. One must be jogged (cut out) to fit around the back corner posts (F). An oblong hole, 10 inches long and $7\frac{1}{2}$ inches wide, is cut in the seat. The edge should be smoothly rounded or beveled. An extra (removable) seat for children may be made by cutting a board 1 inch thick, 15 inches wide, and 20 inches long; in this seat a hole is cut, measuring 7 inches long by 6 inches wide; the front margin of this hole should be about 3 inches from the front edge of the board. To prevent warping, a cross cleat is nailed on top near or at each end of the board.

A cover (*k*) to the seat should measure 1 inch thick by 15 inches wide by 20 inches long; it is cleated on top near the ends to prevent warping; it is hinged in back to a strip 1 inch thick, 3 inches wide, and 20 inches long, which is fastened to the seat. Cleats (*m*) may also be nailed on the seat at the sides of the cover. On the inside of the back board, 12 inches above the seat, there should be nailed a block (*l*), 2 inches thick, 6 inches long, extending forward $3\frac{1}{4}$ inches; this is intended to prevent the cover from falling backward and to make it fall down over the hole when the occupant arises.

On the floor of the box, underneath the seat (fig. 7), two or three cleats (*n*) are nailed in such a position that the tub will always be in the center; the position of these cleats depends upon the size of the tub.

Back trapdoor.—In making the back of the privy (fig. 7), the two center boards (*c*) were sawed at the height of the bottom of the seat. The small portions (c^2) sawed off (23 inches long) are cleated (*o*) together so as to form a back trapdoor which is hinged above; a bolt or a button is arranged to keep the door closed.

Front door.—The front door (fig. 6) is made by cleating (*p*) together three boards (*q*) 1 inch thick, 10 inches wide, and (when finished) 6 feet 7 inches long; it is best to use three cross cleats (*p*) (1 inch thick, 6 inches wide, 30 inches long), which are placed on the

inside. The door is hung with two hinges (6-inch "strap" hinges will do), which are placed on the right as one faces the privy, so that the door opens from the left. The door should close with a coil spring (cost about 10 cents) or with a rope and weight, and may fasten on the inside with a catch or a cord. Under the door a cross-piece (*r*) 1 inch thick, 4 inches wide, 30 inches long (when finished) may be nailed to the joist. Stops (*s*) may be placed inside the door as shown in figure 6. These should be 1 inch thick, 3 inches wide, and 6 feet 6 inches long, and should be jogged (cut out) (*t*) to fit the cross cleats (*p*) on the door. Close over the top of the door place a strip 1 inch thick, 2 inches wide, 30 inches long, nailed to I (fig. 9). A corresponding piece (*v*) is placed higher up directly under the roof, nailed to G. A strap or door pull is fastened to the outside of the door.

Ventilators.—There should be 5 ventilators (*w*). One is placed at each side of the box, directly under the seat; it measures 6 to 8 inches square. Another (12 inches square) is placed near the top on each side of the privy. A fifth (30 inches long, $8\frac{1}{2}$ inches wide) is placed over the door, between G and I_1 (figs. 6, 9). The ventilators are made of 15-mesh copper wire, which is first tacked in place and then protected at the edge with the same kind of lath that is used on the cracks and joints.

If the L. R. S. system (p. 17) is used and the barrel or tank brought close to the seat, the ventilators at the sides of the box may be done away with, and the barrel may be ventilated by a pipe (such as a joint of stove pipe), extending through the seat to the roof or through the back of the house; this ventilator should be screened.

Lath.—Outside cracks (joints) are covered with lath $\frac{1}{2}$ inch thick by 3 inches wide.

Receptacle.—For a receptacle, saw a water-tight barrel to fit snugly under the seat; or purchase a can or tub, as deep (17 inches) as the distance from the under surface of the seat to the floor. If it is not possible to obtain a tub, barrel, or can of the desired size, the receptacle used should be elevated from the floor by blocks or boards so that it fits snugly under the seat. A galvanized can measuring 16 inches deep and 16 inches in diameter can be purchased for about $1, or even less. An empty candy bucket of about the same size can be purchased for about 10 cents.

This same outhouse may be used for the L. R. S. privy (p. 17), in which case it is not necessary to extend the floor under the seat; instead of doing this, a hole is dug deep enough to receive the barrel or vault; or if preferred, the house can be elevated high enough to make room for the barrel (see fig. 3).

Order for material.—The carpenter has made out the following order for lumber (pine, No. 1 grade) and hardware to be used in building a privy such as is shown in figure 6:

1 piece, 6 by 6 inches by 8 feet long, 24 square feet.
1 piece, 4 by 4 inches by 12 feet long, 16 square feet.
5 pieces, 2 by 4 inches by 16 feet long, 54 square feet.
3 pieces, 1 by 6 inches by 16 feet long, 24 square feet.
2 pieces, 1 by 9 inches by 9 feet long, 14 square feet.
3 pieces, 1 by 10 inches by 7 feet long, 18 square feet.
15 pieces, 1 by 12 inches by 12 feet long, 180 square feet.
12 pieces, ½ by 3 inches by 16 feet long, 48 square feet.
2 pounds of 20-penny spikes.
6 pounds of 10-penny nails.
2 pounds of 6-penny nails.
7 feet screen, 15-mesh, copper, 12 inches wide.
4 hinges, 6-inch "strap," for front and back doors.
2 hinges, 6-inch T, or 3-inch "butts," for cover.
1 coil spring for front door.

According to the carpenter's estimate these materials will cost from $5 to $10, according to locality.

There is some variation in the size of lumber, as the pieces are not absolutely uniform. The sizes given in the lumber order represent the standard sizes which should be ordered, but the purchaser need not expect to find that the pieces delivered correspond with mathematical exactness to the sizes called for. On this account the pieces must be measured and cut to measure as they are put together.

ESTIMATE OF MATERIAL FOR SCHOOL OR CHURCH PRIVY.

The following estimate of building materials has been made, by a carpenter, for the construction of a six-seated school or church privy. The estimated cost of these materials is $25 to $50, according to locality; this does not include the pails or barrels:

3 pieces, 6 by 6 inches by 20 feet, 180 square feet.
1 piece, 6 by 6 inches by 8 feet, 24 square feet.
Scantling, 2 by 4 inches, 165 square feet.
Boards, 1 by 12 inches, 600 square feet.
Boards, 1 by 10 inches, 185 square feet.
Boards, 1 by 8 inches, 100 square feet.
Boards, 1 by 6 inches, 80 square feet.
Boards, ½ by 3 inches, 100 square feet.
Flooring, 80 square feet.
40 feet 15-mesh copper wire screen, 12 inches wide.
12 pairs of hinges, 6-inch "strap."
6 pairs of hinges, 6-inch T.
3 pounds of 20-penny spikes.
15 pounds of 10-penny nails.
8 pounds of 6-penny nails.
6 coil springs for front doors.
6 knobs or latches.

HOW TO KEEP A PRIVY SANITARY.

It is necessary not only to build a privy properly but also to keep it in proper condition. This involves cleaning out and disposing of the excreta in such a way as to prevent all possibility of the spread of disease germs from the material. The disagreeable labor involved varies according to the kind of privy in use, but is less with the L. R. S. privy than with the other types.

Wrong ways of disposing of night soil.—(1) The point can not be emphasized too strongly that the use of fresh night soil as fertilizer endangers the health and life not only of every person on the farm itself, but of all people who handle or who consume the fresh vegetables and fresh milk from such a farm. The custom is forbidden by law in some States.

(2) If the fresh night soil is simply buried, germs of disease may later be brought to the surface, and thus infection may be spread. Further, the popular idea that all the fly grubs in the night soil are killed by burial is not correct, for these grubs can crawl up through as much as 6 feet of sand, reach the surface, develop into flies, and carry filth and disease germs to the food. Further, also, if the fresh night soil is buried, it may infect the water supply (springs, wells, etc.), and thus spread disease. Widespread as is the custom of burying fresh excreta, it is a custom which in the light of present-day knowledge must be viewed as being far from safe, although when done with great care it does decrease the dangers to some extent.

(3) Mixing night soil with manure is especially dangerous, and feeding it to chickens and hogs is both filthy and dangerous.

(4) To leave the night soil on the ground near the privy is deliberately to expose the family and neighbors to sickness.

(5) In some instances farmers collect the fresh night soil from towns and villages, and haul it to their farms, under the impression that if it is promptly plowed under it will enrich the land and no harm can result. Farmers should thoroughly understand that the following of such a practice is attended with great danger, as typhoid fever, hookworm disease, and other infections may thereby be introduced from the town to a healthful farm.

(6) In some instances, the privy is built over a creek, or the fresh excreta are thrown into a stream or lake. Such practices may endanger the lives of persons living downstream.

The right way to dispose of night soil.—Since it is not known, at any given time, which members of a community harbor disease germs in their intestines, the invariable rule should be adopted to consider all fresh night soil as a virulent poison and to dispose of it accordingly.

The only safe way of disposing of fresh night soil from the style of privy shown in figures 6 and 7 is to burn it or disinfect it by means

of heat. Any other method, such as burial or any practicable treatment with chemical disinfectants (lime, etc.), although lessening the danger to some extent, still carries with it risks involving human life.

If the wet method (p. 16) be used in the style of privy shown in figures 6 and 7, the excreta had best be heated to 212° F., after which the material may safely be used as fertilizer. A second method is to permit the filth to ferment in water in covered tubs or barrels for not less than a week after removal from the privy; then pour in a disinfectant (such as chloride of lime, one-fourth pound to the gallon of excreta); the material should then be buried. This second method greatly reduces but does not entirely remove the danger of the spread of disease.

Effluent (overflow) from the L. R. S. privy.—From what has been said above, it is clear that the proper disposal of night soil always involves some labor and trouble, but it is important constantly to hold in mind the truth that the results obtained, in better health, smaller doctors' bills, and the saving of human life, more than justify the efforts expended.

The L. R. S. privy reduces the volume of the excreta and converts the material into an easily manageable fluid, so that the disposal of night soil from this type of privy is much simplified. The methods of disposal which come into consideration are the following:

(1) Heat: If a suitable (metallic) vessel is provided to receive the effluent, a fire may be built under the vessel and the effluent heated to 212° F. Or if a wooden or concrete effluent tank is used, the effluent may be transferred to some other vessel for heating.

After such treatment the fluid may be safely used for fertilizer under any conditions.

Heat disinfection is the only measure which can to-day be recommended unreservedly.

(2) Burial: Burial will unquestionably decrease the danger of spreading infection, but in the present state of knowledge this method of disposal can not be relied upon as safe. If burial of the effluent is practiced, the fluid should be disposed of not less than 300 feet from and downhill from any neighboring water supply and not less than 2 feet underground, and then only provided the soil itself is a good filter. Burial in a limestone region may contaminate water supplies miles away.

(3) Chemical disinfection: Chemical disinfectants, such as chlorinated lime and certain coal-tar derivatives, have the great advantage of cheapness and can be relied upon to destroy the disease-causing bacteria in the night soil. The knowledge regarding the action of chemical disinfectants upon the eggs and spores of the various animal parasites is at present very rudimentary, but, so far as results are known, their practicable use does not seem to be so efficient in the

destruction of the animal parasites as of the bacteria. Therefore, pending further investigations, the use of chemically treated excrement as fertilizer should not be regarded as unqualifiedly safe.

(4) Chemical disinfection, with subsequent burial: Inasmuch as chemical disinfection can be relied upon to destroy the disease-producing bacteria in night soil, and inasmuch as burial greatly reduces the danger from animal parasites, a suitable combination of the two methods (chemical disinfection and burial) can be used with reasonable safety.

(5) Sewers: In partially sewered towns the effluent from these privies may be emptied into the sewers. If conditions are such that the addition of this material to the sewage is dangerous, then the entire sewer system needs correction.

THE PRIVY AT THE COUNTRY SCHOOL AND CHURCH.

Although a farmer may prevent soil pollution on his own farm by the use of sanitary privies, his children may be exposed to the dangers of soil pollution at the schools which they attend, and his entire family may be so exposed even when they attend church, unless the schools and churches are provided with sanitary privies. In fact, schools and churches not provided with such outhouses necessarily form distributing centers from which certain diseases spread to clean farms.

CIVIC RESPONSIBILITY IN RESPECT TO PRIVIES.

Lack of sanitary privies on neighboring farms may be responsible for cases of typhoid fever, hookworm disease, and other infections on farms which are provided with sanitary privies, because disease germs may be carried for considerable distances by flies, by animals, by feet of persons, by wagon wheels, or by drainage from one farm to another.

In view of these well-established facts it is evident that among the highest duties that rest upon a farmer, as a father and citizen, is not only to have a sanitary privy on his farm, but to insist that the pollution of soil with human excreta be prevented throughout the entire neighborhood by the use of sanitary privies.

In the United States about 400,000 persons suffer from and about 35,000 die from typhoid each year; over 2,000,000 persons have hookworm disease. Thousands of these deaths and many thousands of these cases of disease might be prevented by the simple use of sanitary privies. A compulsory sanitary privy law or ordinance should therefore be enacted and be strictly enforced in every locality not provided with a properly maintained sewer system.

463

○